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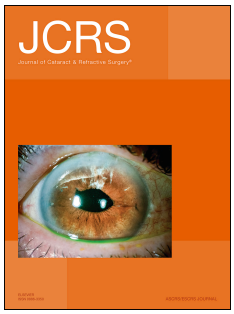

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Static and Dynamic Pupillary Characteristics in High Myopic Eyes with Implanted Collamer Lenses V4 and V4c

Running head: Pupil Change of ICL V4 VS V4c

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Abstract

Purpose: To determine **s**tatic and dynamic pupillometry characteristics before and after implantable collamer lenses (ICLs, V4 and V4c) implantation.

Setting: Shanghai, China.

Design: Prospective consecutive observational case series.

Methods: A total of 98 eyes (50 patients) underwent V4 or V4c ICL implantation were included in this observational study. An automatic quantitative pupillometry system (MonCv3; Metrovision, Pérenchies, France) was used for pupillometry before and 1 week, 1 month, and 3 months after surgery. Static pupillometry measurements (pupil diameters at four standardized illumination levels) and dynamic parameters (including initial pupil diameter, amplitude of contraction, latency of contraction, duration of contraction, velocity of contraction, latency of dilation, duration of dilation, and velocity of dilation) were measured.

Results: Mesopic and low photopic PDs declined by 0.32 mm and 0.27 mm at 3 months after ICL implantation, respectively; scotopic PD declined at 1 week and recovered to preoperative levels at 3 months; and high photopic PD remained unchanged. Regarding the pupil light reflex, contraction amplitude and velocity declined after surgery, while other dynamic parameters remained unchanged. The static and dynamic pupillary characteristics were similar between the V4 and V4c ICL groups.

Conclusions: The V4 and V4c ICLs had similar influences on iris motility. ICL implantation had a miotic effect under mesopic and low photopic illumination conditions, resulting in decreases in pupil contraction amplitude and velocity in light reflexes.

Key words: myopia, implantable collamer lenses, pupillometry

INTRODUCTION

The Visian implantable collamer lens (ICL; STAAR Surgical, Nidau, Switzerland) has been widely used for the correction of moderate-to-high myopia. Compared to other refractive surgeries, ICL implantation has advantages, including more satisfactory visual quality, retaining the ability to accommodate the crystallin lens, and avoiding irreversible damage to relatively healthy corneal tissue [1–5]. However, the ICL is located in the posterior chamber and is in contact with the posterior surface of the iris, which may lead to a disturbance in pupillary movement.

Pupil diameter (PD) and pupil dynamics play important roles in visual function and are associated with postoperative visual quality and several complications, including halos and night driving problems after ICL implantation. However, the pupillary changes induced by ICL implantation have not been fully elucidated. Few studies have described the effects of ICLs on static or dynamic pupillary characteristics, and the outcomes remain contradictory [6–8].

The latest model, the Visian V4c ICL, is designed with a 360 μm central hole to allow aqueous humor to flow without the need for an iridotomy [9–11]. Avoiding iridotomy and aqueous humor hydrodynamic changes may result in a different effect on iris motility when compared to the conventional V4 ICL. Furthermore, a comparison of the effects on postoperative pupillary characteristics between the V4 and V4c ICLs has not been reported.

The aim of this study was to determine the influence of ICL implantation on PD and pupil light reflexes, and to compare the latest ICL model with the conventional model in terms of their effects on iris motility.

MATERIALS AND METHODS

Participants

A total of 98 consecutive eyes (50 patients) were included in this prospective observational study, among which 32 eyes (16 patients) underwent V4 ICL implantation and 66 eyes (34 patients) underwent V4c ICL implantation. All surgeries were performed by one surgeon (Z.J.) from September 2016 to December 2017. Table 1 lists the baseline data for all patients.

Written informed consent was obtained from all participants. The Ethics Committee of Shanghai Ninth Peoples' Hospital approved the work. All relevant tenets of the Declaration of Helsinki were followed throughout the study.

The principal inclusion criteria were age > 18 years and moderate-to-high myopia with or without astigmatism. The exclusion criteria were: 1) a central corneal endothelial cell count < 2,000 cells/mm^2; 2) an absolute anterior chamber depth (ACD) < 2.8 mm; 3) any ocular or systemic disease or anomalies that might affect pupillary motility or light perception; and 4) the use of medications that might affect iris mechanics such as tropicamide, cyclopentolate, pilocarpine, non-steroidal anti-inflammatory drugs, prostaglandins, and narcotic-derived

medications.

Measurements

Each eye underwent comprehensive preoperative evaluations. The ACD, trabecular-iris angle, axial length, central corneal thickness, and horizontal white-to-white diameter were assessed using ultrasound biomicroscopy with a Pentacam system (Oculus, Wetzlar, Germany). The following measurements and procedures were carried out: uncorrected distance visual acuity, best-corrected distance visual acuity, manifest refraction [spherical equivalent (SE)], anterior segment evaluation by slit-lamp microscopy, dilated funduscopic examination, intraocular pressure (IOP) measurement, endothelial cell density, and corneal topography. The ICL power was calculated by either the modified vertex formula or the astigmatism decomposition method, according to recommendations of the manufacturer (STAAR Surgical).

Surgical Procedure

ICL implantation was performed by a single surgeon (Z.J.) following standard procedures. Iridectomies were performed using a neodymium-yttrium-aluminum-garnet laser, preoperatively for the V4 ICL group. Mydriatics and anesthesia were topically administered on the day of surgery. After filling the anterior chamber with 1.0% (w/v) sodium hyaluronate, clear 3.0 mm corneal incisions were made to insert the ICLs. ICLs were placed in the posterior chamber and aligned horizontally, while toric ones were rotated as required from the horizontal axis. Irrigation/aspiration was used to remove the sodium hyaluronate solution

completely. When ICL implantation was completed, the pupils were constricted with 0.01% (w/v) acetylcholine. Eye drops containing 0.3% (w/v) tobramycin and 0.1% (w/v) dexamethasone (Tobradex®) were applied three times daily for 1 week, then tapered off over 2 weeks. The medication could be adjusted at any time, based on monitoring of the IOP.

Pupillometry

Pupillometry was performed by a single physician under the same environmental conditions before and 1 week, 1 month, and 3 months after surgery. To minimize the effect of circadian variation on PD and pupil motility, all measurements were performed at the same time of day (between 9:00 a.m. and 11:00 a.m.). A computerized automatic pupillometry system (MonCv3; Metrovision, Pérenchies, France) was used, which was equipped with near-infrared illumination and a high-resolution camera (880 nm) that provided both static and dynamic measurements and accurate determinations of the PD (accuracy = 0.1 mm). The MonCv3 recorded the pupil using binocular vision, which better approximated the physical condition than monocular vision devices.

Static pupillometry was conducted for the PD (mm) under four standardized illumination conditions: scotopic (0.1 cd/m^2), mesopic (1 cd/m^2), low photopic (10 cd/m^2), and high photopic (100 cd/m^2). At least three consecutive measurements of PD were taken at each illumination level, and the average values were selected for analysis.

After 15 min of dark adaptation, dynamic pupillometry was measured for the pupil response

to automatic-released white light flashes (stimulation ON time of 200 ms, stimulation OFF time of 3,300 ms, total luminance of 100 cd/m^2, and total intensity of 20 lux) in darkness. Images of both eyes were acquired and processed in real time (30 images/second), from which pupillary contours were automatically outlined and recorded. After at least three valid responses were recorded, the average pupil dynamics were automatically quantified, including the resting PD in mm, amplitude of pupil contraction in mm, latency of pupil contraction in ms, duration of pupil contraction in ms, velocity of pupil contraction in mm/s, latency of pupil dilation in ms, duration of pupil dilation in ms, and velocity of pupil dilation in mm/s.

Statistical Analysis

All results are expressed as the mean ± standard deviation. Changes in PD and pupil dynamics over time were assessed using a repeated measures analysis of variance (ANOVA) among the four time points (preoperative and 1 week, 1 month, and 3 months after surgery). When the difference was significant, the data between each time point were compared using Least Significant Difference post-hoc analysis. Generalized estimating equation (GEE) models were used to compare the V4 and V4c ICL groups after adjusting for age, SE, and within-patient intereye correlations. All statistical analyses were performed using SPSS for Windows (version 22.0; IBM Corp., Armonk, NY, USA). A *P*-value < 0.05 was considered statistically significant.

RESULTS

No intraoperative or short-term postoperative complication was observed in any of the 98 eyes. Static and dynamic pupillary characteristics before and 1 week, 1 month, and 3 months after ICL implantation are listed in Table 2 and Figure 1.

Static Pupillary Characteristics

Under scotopic (0.1 cd/m^2) illumination, the PD declined significantly by 0.79 mm at 1 week ($P < 0.001$) and by 0.23 mm at 1 month ($P = 0.015$) after ICL implantation. At 3 months after implantation, PD had recovered to the preoperative level ($P = 0.318$).

At the mesopic (1 cd/m^2) illumination level, the postoperative PD declined significantly by 0.67 mm at 1 week ($P < 0.001$), by 0.37 mm at 1 month ($P = 0.004$), and by 0.32 mm at 3 months ($P = 0.044$) after implantation compared to preoperative values.

Using a low photopic (10 cd/m^2) condition, PD declined significantly after surgery at 1 week by 0.44 mm ($P < 0.001$), at 1 month by 0.29 mm ($P = 0.003$), and at 3 months by 0.27 mm ($P = 0.006$) compared to preoperative values.

At a high photopic (100 cd/m^2) illumination level, the PD remained unchanged at all time points.

No significant difference was detected for any static pupillary parameter between the last two follow-up time points at 1 month and 3 months after surgery.

Dynamic Pupillary Characteristics

Compared to preoperative values, the initial PDs declined significantly after surgery at all time points ($P < 0.001$ at 1 week, $P = 0.006$ at 1 month, and $P = 0.002$ at 3 months). In addition, the amplitude of contraction declined significantly ($P < 0.001$ at 1 week, $P < 0.001$ at 1 month, and $P < 0.001$ at 3 months), and the velocity of contraction declined significantly ($P < 0.001$ at 1 week, $P = 0.001$ at 1 month, and $P = 0.020$ at 3 months). The differences in these parameters between the last two follow-up time points at 1 month and 3 months after surgery were insignificant.

Other dynamic pupillary parameters showed no significant difference among all time points.

Comparison of V4 and V4c ICLs

The static and dynamic pupillary characteristics of the V4 and V4c ICL groups are shown in Tables 3 and 4.

Under the four standardized static illumination conditions, the PDs of eyes implanted with V4 and V4c ICLs showed no significant difference at each time point after adjusting for age, preoperative SE, and within-patient intereye correlations.

Regarding the pupil light reflex, the velocity of dilation at 1 week after surgery was significantly slower in the V4 ICL group than the V4c ICL group ($P = 0.015$, GEE model adjusted for age, SE, and within-patient intereye correlations). No other dynamic pupillary characteristic was found to be statistically different between the two ICL groups at each time point.

In the V4 ICL group, the velocity of dilation decreased significantly at 1 week after surgery ($P = 0.004$), then recovered to the preoperative level at 1 month ($P = 0.521$) and 3 months after surgery ($P = 0.962$). In the V4c ICL group, the velocity of dilation showed no significant change before and after surgery (Table 4).

DISCUSSION

The results of the current study indicate that the PD decreased after ICL implantation under mesopic and low photopic conditions. Scotopic PD declined at 1 week after surgery and then recovered to the preoperative level at 3 months, while the high photopic PD remained unchanged. The pupil light reflex showed a smaller contraction amplitude and slower contraction velocity after surgery. The static and dynamic pupillary characteristics were similar between the V4 and V4c ICL groups, except for a slower dilation velocity in the ICL V4 group at 1 week after surgery.

Previous studies have shown contradictory results for the influence of ICL implantation on

PD. Kazuko [6] reported that the PD remained unchanged before and 1, 3, and 6 months after V4c ICL implantation under non-standardized illumination levels. Kamiya [7] reported the recovery of PD at 1 week after ICL implantation, even though there was a significant decrease at 1 day after surgery. They measured the PD under low light conditions (10 lux) with monocular vision after only 3 min of dark adaption. Keuch [8] reported a PD decrease of 0.7 mm at 2 weeks after ICL implantation, consistent with our findings. In this final study, the PD was measured during dynamic light reactions under unknown illumination conditions with monocular vision.

Our results suggest that the postoperative PD decreased under mesopic and low photopic conditions. The maximal decline occurred at 1 week after surgery. Despite recovery over time, a significant decrease was still detected at 3 months when compared to the preoperative level. The discordance of our findings with those of Kazuko [6] and Kamiya [7] may have been due to the following reasons: 1) their measurements were not taken under standardized illumination levels; 2) the pupil recording devices were different in each study, and devices with monocular vision have been reported to result in bias from physiological binocular vision conditions [12–15]; and 3) the sample sizes were relatively small in these previous studies (28 and 30 eyes, respectively; sample sizes are a critical factor in statistical analyses).

Studies evaluating the effect of cataract surgery on PD have also shown postoperative PD decreases, with the main cause being mechanical irritation of uveal tissue [16–20]. Regarding the mesopic and low photopic PD decreases after ICL implantation in our study, mechanical

irritation of uveal tissue may have been at least partially responsible. However, we suggest that another reason was the miotic effect of the accommodation-convergence reflex induced by fixation. To control fixation stability during pupil recording, we required participants to fixate on a target in the center of the test field, which could be clearly seen under mesopic and low photopic conditions. The fixation-induced miotic effect was minimal before surgery because of high myopia, and then became significant after surgery because the myopia was corrected by ICL implantation.

Regarding dynamic pupillary characteristics, our findings reveal decreases in contraction amplitude and velocity, which we believe to be associated with the smaller initial postoperative PD. Mechanical contact of the ICL and iris, and irritation of uveal tissue may have contributed to the decreases in contraction amplitude and velocity. The latencies and durations of each phase of the pupil light reaction remained unchanged after surgery, suggesting that the autonomic nervous system and neural visual pathway were unaffected by ICL implantation. Kazuko [3] reported unchanged dynamic pupillary parameters after ICL implantation, and decreasing trends in postoperative contraction amplitude and velocity were observed, although they were not statistically significant. Keuch [5] reported a sluggish pupil light reaction after ICL implantation, with prolonged constriction latency and duration as well as a decreased amplitude and rate. However, the different outcomes may have resulted from the monocular vision devices used in their studies.

In the V4 ICL group, the dilation velocity decreased at 1 week and then recovered at 1 month

after surgery. We assumed that the main reason was impairment of the dilator pupillae muscle by laser periphery iridectomy (LPI). In the V4c ICL group, the dilation velocity remained unchanged because LPI was avoided by using a designed 360 μm central hole. However, other dynamic pupil parameters and static PDs under the four standardized illumination conditions were similar between the V4 and V4c ICL groups at each time point. These results suggest that the central hole and aqueous humor hydrodynamic difference had little influence on iris motility.

A limitation of the present study is the relatively small sample size of the V4 ICL group. Because the V4 ICL had been withdrawn from the Chinese market, we could not include more V4 ICL cases. Age is an important factor affecting pupillary characteristics [21,22]. Most patients included in the current study were relatively young; the average age was 26.5 years, so generalizations of the present findings may be limited. Additional studies with greater sample sizes and longer follow-up periods are warranted to confirm our findings.

In conclusion, our findings show that ICL implantation surgery had a collateral effect on pupil size and resulted in a smaller pupil under mesopic and low photopic conditions. The V4 and V4c ICLs seem to have similar effects on pupillary characteristics. Because of an artificial hole in the optic center and smaller postoperative PD, the increased possibility of dysphotopsia or stray light after ICL V4c implantation should be considered.

WHAT WAS KNOWN

•The new version of ICL, which is designed with a 360 μm central hole to avoid iridotomy, appears to achieve comparable visual outcomes. While its influence on pupil diameters and pupil light reflax has not been studied, especially compared with conventional ICL type.

WHAT THIS PAPER ADDS

•. ICL implantation had a miotic effect under certain illumination conditions, resulting in decreases in pupil contraction amplitude and velocity in light reflexes.

•The aqueous humor hydrodynamics and the stress state of iris resulting from ICL V4 and V4c are different. While the pupillary characteristics after implantation of ICL V4 and V4c are similar.

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Figure Legends

Figure 1: Static and dynamic pupillary characteristics of 98 eyes before and after surgery. Pre, presurgery; 1W, 1 week after surgery; 1M, 1 month after surgery; 3M, 3 months after surgery. Top left, static pupil diameters under four standardized illumination conditions; top middle, initial pupil diameters of pupil light reflex; top right, amplitude of contraction of the pupil light reflex; bottom left, latency of contraction and latency of dilation of pupil light reflex. LC, latency of contraction; LD, latency of dilation. Bottom middle, duration of contraction and duration of dilation of the pupil light reflex; DC, duration of contraction; DD, duration of dilation. Bottom right, velocity of contraction and velocity of dilation of the pupil light reflex; VC, velocity of contraction; VD, velocity of dilation.

TABLE 1. Baseline clinical data of eyes undergoing implantation of V4 or V4c implantable collamer lenses (means ± SDs).

	ICL V4	ICL V4c
Patients, n	16	34
Eyes, n	32	66
Sex, n		
Male	7	13
Female	9	21
Age, years	23.9 ± 3.7	27.7 ± 7.6
	(range, 18 – 31)	(range, 18 – 42)
Preoperative spherical equivalent, D	−12.4 ± 3.6	-10.8 ± 3.3
Preoperative sphere, D	−11.4 ± 3.5	-10.1 ± 3.0
Preoperative cylinder, D	−2.0 ± 1.0	-1.4 ± 1.1

SD = standard deviation; D: diopters.

TABLE 2. Static and dynamic pupillary characteristics of included 98 eyes before and 1 week, 1 month, 3months after ICL implantation (means ± SDs, mm).

Parameter	Pre-operation	1 week	1month	3months	*F*	*P* value
Scotopic PD, 0 cd/m^2 (mm)	6.52 ± 0.75	5.96 ± 0.67	6.29 ± 0.61	6.43 ± 0.62	13.678	<0.001*
Mesopic PD, 1 cd/m^2 (mm)	5.07 ± 0.93	4.40 ± 0.93	4.70 ± 0.81	4.75 ± 0.92	9.553	<0.001*
Low photopic PD, 10 cd/m^2 (mm)	4.00 ± 0.76	3.56 ± 0.69	3.71 ± 0.62	3.73 ± 0.67	7.103	<0.001*
High photopic PD, 100 cd/m^2 (mm)	2.90 ± 0.43	2.81 ± 0.37	2.90 ± 0.37	2.88 ± 0.34	1.213	0.305
Initial pupil diameter (mm)	5.06 ± 0.67	4.57 ± 0.57	4.81 ± 0.64	4.78 ± 0.59	10.153	<0.001*
Amplitude of contraction (mm)	1.97 ± 0.29	1.66 ± 0.27	1.76 ± 0.30	1.82 ± 0.28	21.577	<0.001*
Latency of contraction (ms)	249.20 ± 56.30	241.31 ±64.46	237.79 ± 62.06	252.67 ± 47.34	1.383	0.248
Duration of contraction (ms)	631.09 ± 64.97	643.22 ± 89.73	644.68 ± 80.91	624.70 ± 82.71	1.422	0.236
Velocity of contraction (mm/s)	6.16 ± 0.73	5.23 ± 1.17	5.63 ± 1.66	5.77 ± 0.82	10.796	<0.001*
Latency of dilation (ms)	879.00 ± 53.51	884.53 ± 67.33	884.63 ± 68.51	879.65 ± 71.06	0.212	0.888
Duration of dilation (ms)	1585.97 ± 80.82	1566.96 ± 107.17	1583.40 ± 81.94	1579.96 ± 85.99	0.870	0.457
Velocity of dilation (mm/s)	2.42 ± 0.46	2.37 ± 0.74	2.50 ± 0.62	2.50 ± 0.54	0.976	0.404

SD = standard deviation; PD: pupil diameter; *P*-values for the ANOVA tests performed among the four time-points (pre-operation, 1 week, 1 month and 3 months after surgery).

*Statistically significant difference.

TABLE 3. Pupil diameter of ICL V4 and V4c groups under standardized illumination levels before and 1 week, 1 month, 3months after ICL implantation (means ± SDs, mm).

Illumination level		Pre-operation	1 week	1month	3months	*F*	*P*-value
0 cd/m^2	ICL V4	6.72 ± 0.65	5.93 ± 0.57	6.43 ± 0.55	6.73 ± 0.61	11.162	< 0.001*
	ICL V4c	6.43 ± 0.78	5.97 ± 0.71	6.23 ± 0.63	6.32 ± 0.60	5.528	0.001*
1 cd/m^2	ICL V4	4.75 ± 0.66	4.15 ± 0.61	4.49 ± 0.50	4.56 ± 0.56	5.995	0.001*
	ICL V4c	5.22 ± 1.01	4.52 ± 1.03	4.80 ± 0.91	4.93 ± 0.98	5.788	0.001*
10 cd/m^2	ICL V4	3.86 ± 0.70	3.41 ± 0.53	3.52 ± 0.42	3.58 ± 0.54	3.832	0.012*
	ICL V4c	4.07 ± 0.78	3.63 ± 0.74	3.82 ± 0.70	3.80 ± 0.72	4.061	0.008*
100 cd/m^2	ICL V4	2.79 ± 0.42	2.72 ± 0.33	2.81 ± 0.32	2.85 ± 0.29	0.721	0.542
	ICL V4c	2.95 ± 0.42	2.86 ± 0.37	2.95 ± 0.39	2.90 ± 0.35	0.910	0.437

SD = standard deviation; ICL V4, n = 32; ICL V4c, n = 66; *P*-values for the ANOVA tests performed among the four time points (pre-operation, 1 week, 1 month and 3 months after surgery).

*Statistically significant difference between time-points.

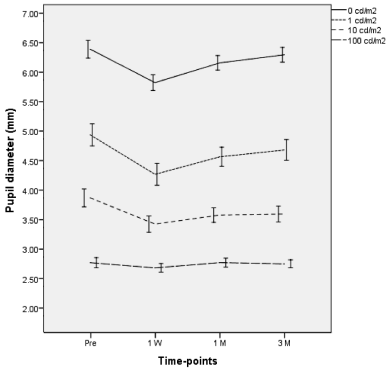
TABLE 4. Dynamic pupil parameters of ICL V4 and V4c groups before and 1 week, 1 month, 3months after ICL implantation (means ± SDs).

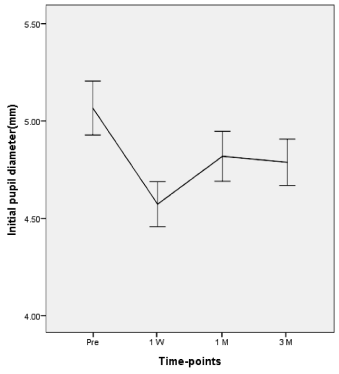
Parameter		Pre-operation	1 week	1month	3months	*F*	*P* value
Initial pupil diameter(mm)	ICL V4	5.00 ± 0.53	4.50 ± 0.45	4.77 ± 0.48	4.80 ± 0.40	6.132	0.001*
	ICL V4c	5.09 ± 0.75	4.60 ± 0.62	4.83 ± 0.70	4.78 ± 0.66	5.651	0.001*
Amplitude of contraction (mm)	ICL V4	2.06 ± 0.27	1.66 ± 0.28	1.85 ± 0.25	1.89 ± 0.22	12.817	<0.001*
	ICL V4c	1.93 ± 0.29	1.65 ± 0.26	1.72 ± 0.31	1.78 ± 0.30	11.323	<0.001*
Latency of contraction (ms)	ICL V4	261.69 ± 35.02	261.78 ± 49.91	250.59 ± 53.40	266.03 ± 27.80	0.761	0.518
	ICL V4c	243.15 ± 63.50	231.38 ±68.61	231.58 ± 65.33	246.20 ± 53.35	0.993	0.397
Duration of contraction (ms)	ICL V4	617.38 ± 58.05	629.41 ± 81.32	632.94 ± 50.33	628.47 ± 63.57	0.350	0.789
	ICL V4c	637.74 ± 67.48	649.92 ± 93.39	650.38 ± 91.98	622.88 ± 90.95	1.479	0.221
Velocity of contraction (mm/s)	ICL V4	6.35 ± 0.66	5.16 ± 0.95	5.72 ± 0.65	5.93 ± 0.60	14.829	<0.001*
	ICL V4c	6.07 ± 0.75	5.27 ± 1.27	5.58 ± 1.98	5.70 ± 0.91	4.163	0.007*
Latency of dilation (ms)	ICL V4	879.06 ± 50.35	891.19 ± 80.37	886.06 ± 50.35	900.97 ± 53.17	0.750	0.525
	ICL V4c	878.97 ± 54.67	881.30 ± 60.45	883.94 ± 76.11	869.32 ± 76.51	0.687	0.624
Duration of dilation (ms)	ICL V4	1604.50 ± 71.32	1590.53 ± 81.74	1600.34 ± 55.35	1589.38 ± 55.60	0.392	0.759
	ICL V4c	1576.98 ± 84.09	1555.53 ± 116.39	1575.18 ± 91.37	1575.39 ± 97.44	0.713	0.545
Velocity of dilation (mm/s)	ICL V4	2.34 ± 0.40	2.03 ± 0.48**	2.41 ± 0.44	2.35 ± 0.36	5.276	0.002*
	ICL V4c	2.47 ± 0.49	2.55 ± 0.79**	2.54 ± 0.70	2.58 ± 0.60	0.317	0.813

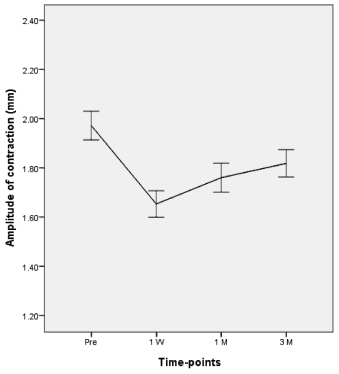
SD = standard deviation; ICL V4, n = 32; ICL V4c, n = 66; *P*-values for the ANOVA tests performed among the four time points (pre-operation, 1 week, 1 month and 3 months after surgery).

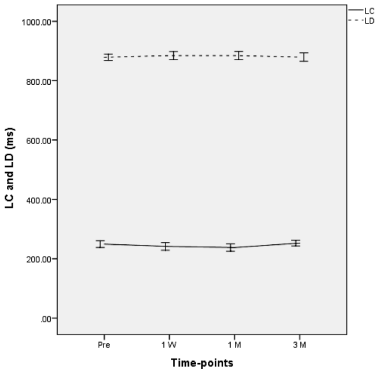
*Statistically significant difference between time-points.

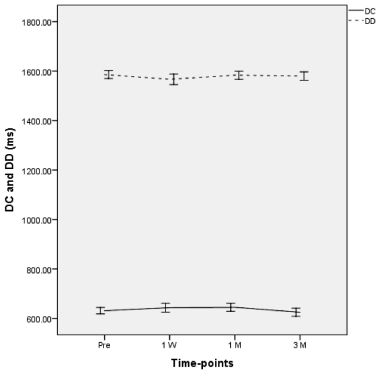
** Statistically significant difference between ICL V4 and V4c groups.

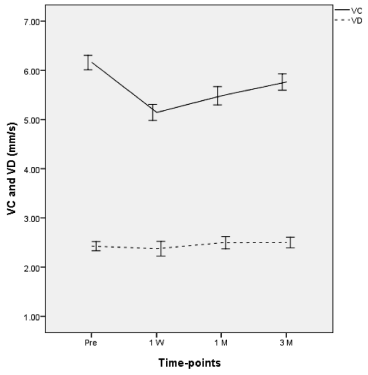












Synopsis

ICL implantation can has a miotic effect and result in smaller and slower light reflexes. The central hole of new ICL type has limited influence on iris motility.